

# APPLICATION UNDER UNITED STATES PATENT LAWS

Invention: **RECHARGING KEY BASED WIRELESS DEVICE**

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This is a:

- ☐ [ ] Provisional Application
- ☒ [X] Regular Utility Application
- ☐ [ ] Continuing Application
- ☐ [ ] PCT National Phase Application
- ☐ [ ] Design Application
- ☐ [ ] Reissue Application
- ☐ [ ] Plant Application

## SPECIFICATION

# RECHARGING KEY BASED WIRELESS DEVICE

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

5                This invention relates generally to rechargeable devices. More particularly, it relates to a rechargeable short range wireless device such as a BLUETOOTH™ network device.

### 2. Background

10                Key ring devices provide convenience features popular among users. For instance, people now put on their key rings various electronic devices such as automobile keyless entry remote controllers, security enable/disable devices, remote access random code generators, penlights, to name just a few. In the near future, people will want other  
15                things miniaturized and included on a key chain. For instance, a garage door opener may be added to their key chain.

                 These all require power, which means they all need batteries to be replaced. When the power runs out unexpectedly, those important devices will not function when needed. Thus, an interruption is often  
20                associated with realization of the need for new batteries, purchase of the necessary batteries, and replacement of the batteries.

                 Fig. 8 shows a conventional key penlight device.

                 In particular, as shown in Fig. 8, a key chain penlight device  
25                800 includes a captured key 850 suitable for the particular application (e.g., for the ignition of an automobile). The key chain penlight device 800 also includes an illumination source 840 (e.g., incandescent bulb, LED, laser, etc.), and one or more batteries 820. Most key chain penlight devices 800 also include a user operated pushbutton switch 830 to activate the illumination source 840.

The conventional key chain penlight device **800** is typically used for a period of time, then discarded after the batteries **820** become drained. Few users take the time to determine the necessary replacement type batteries, find a store that sells that type battery and make the purchase, disassemble the key chain penlight device **800** to gain access to the batteries **820**, then reassemble the key chain penlight device **800**. Most users simply stop using the illumination source **840** after the batteries **820** run out.

There is a need for a user friendly technique of maintaining battery power in key chain devices, particularly for a technique and apparatus relieving the user from the need to remember to replace batteries in key chain devices.

#### **SUMMARY OF THE INVENTION**

In accordance with the principles of the present invention, a key chain rechargeable device comprises key securing structure, an electronic device associated with the key securing structure, and a rechargeable battery source to power the electronic device. The key chain rechargeable device is recharged from an external power source when a key associated with the securing structure is inserted in a lock device.

A vehicle ignition assembly comprises a lock device and a vehicle ignition switch connected to the lock device. At least two electrical charging connections are associated with the lock device and adapted to provide opposite polarity contacts to a key inserted in the lock device.

A vehicle ignition assembly in accordance with another aspect of the present invention comprises a lock device, a vehicle ignition switch connected to the lock device, and an inductive charging coil adapted to provide battery charging power to a key chain rechargeable device placed proximate to the vehicle ignition assembly.

A method of recharging a key chain electronic device in accordance with yet another aspect of the present invention comprises inserting a key on a key chain in a lock device, and coupling a rechargeable battery of a key chain electronic device to an external power source associated with the lock device only when the key is in the lock device.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

Features and advantages of the present invention will become apparent to those skilled in the art from the following description with reference to the drawings, in which:

Figs. 1A and 1B show exemplary embodiments of a recharging key based wireless device which is recharged when inserted into a matching keyhole (e.g., in the ignition of an automobile), in accordance with the principles of the present invention.

Figs. 2A and 2B show exemplary alternative embodiments of keys including two separate electrical conductors for contact with matching contacts at a matching keyhole, in accordance with the principles of the present invention.

Fig. 3A shows an exemplary alternative embodiment where a device securing a key contacts matching contacts at a matching keyhole, in accordance with the principles of the present invention.

Fig. 3B shows another exemplary alternative embodiment utilizing inductive coupling between an energy coil associated with a power source, e.g., a vehicle, and a recharging coil associated with a key ring in close proximity to the energy coil, in accordance with the principles of the present invention.

Fig. 4 shows implementation of a rechargeable key short range wireless device, such as a BLUETOOTH network device, in accordance with the principles of the present invention.

Fig. 5 shows implementation of a rechargeable key security alarm enable/disable device, in accordance with the principles of the present invention.

Fig. 6 shows implementation of a rechargeable key chain keyless entry remote device, in accordance with the principles of the present invention.

Fig. 7 shows implementation of a rechargeable key penlight device, in accordance with the principles of the present invention.

Fig. 8 shows a conventional key penlight device.

#### DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

Keys are a necessary part of life. People use keys to enter homes and offices, cabinets, drawers, etc. Perhaps most obviously, people use keys to start their automobiles.

The present invention relates to the realization and combination resulting from the significant amount of time a key (particularly an automobile key) spends in its keyhole, and the desire for portable devices to use batteries.

Conventionally, wireless devices, pagers, etc., using rechargeable battery sources require occasional recharging. To recharge a conventional wireless device, a temporary electrical connection is made between the wireless device and a power source (e.g., an AC power outlet, an automobile cigarette lighter, etc.)

The trend in portable devices in today's world is toward reduced size and weight. Using this trend toward miniaturization, the present invention provides a convenient rechargeable battery apparatus and technique allowing expansion of the conventional key chain type devices. For instance, with a rechargeable battery source on a key chain charged when in a proximity of a matching keyhole, wireless devices such

as BLUETOOTH™ network devices, pagers, etc., which require occasional or frequent battery replacement become practical.

5 Figs. 1A and 1B show exemplary embodiments of a recharging key based wireless device which is recharged when inserted into a matching keyhole (e.g., in the ignition of an automobile), in accordance with the principles of the present invention.

10 In particular, Fig. 1A shows a generic key chain rechargeable device **100** including a charging circuit **110** and rechargeable batteries **120**, in accordance with the principles of the present invention. The charging circuit **110** is electrically connected to two electrically separate portions or contacts on a captured key **150**.

15 For instance, as shown in Fig. 1A, a central portion **154** of the captured key **150** is electrically separated from an outer portion **152** of the captured key. The central portion **154** is associated with one polarity of the batteries **120**, e.g., with the positive (+) polarity, and the outer portion **152** is associated with the other polarity of the batteries **120**, e.g., with the negative (-) polarity, as shown in Fig. 1A.

20 Of course, the polarities may be implemented in an opposite relationship than that shown in Fig. 1A, within the scope of the present invention. Moreover, while the disclosed embodiments relate to the implementation of two battery terminals, the present invention relates equally to the implementation of more than two battery terminals to accommodate the recharging of more than one set of batteries.

25 An appropriately outfitted vehicle **110** includes a matching lock tumbler **170** which matches the captured key **150**. In the disclosed embodiment, when the key **150** is inserted fully into the lock tumbler **170**, electrical contact is accomplished between the electrical terminals of the captured key **150** (e.g., the central portion **154** and the outer portion **152**), and associated contacts in the keyhole (e.g., a tip electrical contact **174**  
30 and an outer electrical contact **172**, respectively).

Thus, as shown in the embodiment of Fig. 1A, when the captured key **150** is inserted into the lock tumbler **170**, the central portion **154** of the captured key **150** electrically contacts the tip contact **174**, and the outer portion **152** electrically contacts the outer contact **172**.

5           The keyhole **177** of the vehicle's ignition provides charging contacts to the key **150**, which in turn connects electrically to the rechargeable batteries **120** of the key chain rechargeable device **100**.

10           In accordance with the principles of the present invention, the rechargeable batteries **120** of the key chain rechargeable device **100** will be boosted and charged whenever the car key **150** is in the ignition, freeing the user from consciously affecting recharge of the rechargeable batteries **120**. The more frequently the user drives their car, the more frequently the key chain rechargeable device **100** will be recharged.

15           The car key would have two contacts separated by insulation that would connect a power source inside the car ignition to a rechargeable power source attached to the key. The charging circuit could be attached to the key ring or be part of the car. With this invention, the battery can charge whenever the key is in the ignition.

20           While the embodiment shown in Fig. 1A allows electrical contact (and thus charging power) when the key is merely inserted into the lock tumbler **170** without necessarily turning the key, it is within the scope of the present invention to mechanically restrict electrical contact of one or both contacts **172**, **174** until the key **150** is rotated within the lock tumbler **170**, ensuring that the key **150** is the proper key. This also  
25           eliminates any battery drain from the power source (e.g., from the vehicle battery) when the vehicle is not started, and would function to disconnect the circuit prior to separating the electrical contacts so as to reduce the risk of arcing or shocking.

30           The rechargeable batteries **120** may be one or more of any suitable type rechargeable battery. For instance, the rechargeable battery

or batteries **120** may be nickel-cadmium (Ni-Cad), nickel-metal-hydride (Ni-MH), Lithium-Ion, or even rechargeable Alkaline type.

The charging circuit **110** may be any otherwise conventional charging circuit for charging the appropriate rechargeable batteries **120**,  
5 e.g., for charging Ni-Cad, Ni-MH, or rechargeable alkaline batteries.

The recharging circuit may provide a higher current fast charge type charge, but may alternatively provide a lower current trickle charge type charge to maintain battery power, depending upon the particular application. For instance, trickle charge type charging may be  
10 suitable for low use devices, e.g., key chain penlight devices, whereas a higher current fast charge may be more appropriate for a wireless network device. To allow easy integration of either type charging, it is preferred that the charging circuit **110** be integrated within the key chain device **100** and simply draw power (e.g., 12 volt power) from the source. Moreover,  
15 because of the variety of available rechargeable batteries and their particular charging preferences, it may be best to include the charging circuit in the key chain device. Nevertheless, miniaturization of the key chain devices may be further facilitated by associating the charging circuit **110** with the key hole, e.g., in the vehicle, as shown in Fig. 1B.

20 Preferably, the charging circuit **110** includes an automatic shut-off function to protect against overcharging the rechargeable batteries **120**.

Charger "smarts" could be in the car to simplify the key. For instance, Fig. 1B shows implementation of a recharging circuit **110a** in the  
25 vehicle rather than in the key chain device as shown in Fig. 1A.

Preferably, the recharging circuit will isolate the vehicle battery (or other power source) from the key contacts when removed from the charging key-hole to remove the possibility of shorting the power source.



Figs. 1A and 1B show implementation of two polarity conductors built into the key shaft. Alternative embodiments are of course possible and within the scope of the present invention.

For instance, Figs. 2A and 2B show exemplary alternative  
5    embodiments of keys including two separate electrical conductors for  
contact with matching contacts at a matching keyhole, in accordance with  
the principles of the present invention.

In particular, Fig. 2A shows a top view of the captured key,  
wherein a right side **204** of the captured key **150** is electrically separated  
10    from a left side **202** of the captured key **150** using an insulating layer **206**  
therebetween. Electrical contact with a negative (-) side of the  
rechargeable batteries **120** is made, e.g., with the right side **204** of the key  
**150**, while electrical contact with a positive (+) side of the rechargeable  
batteries **120** is made, e.g., with the left side **202** of the key **150**.

15    Fig. 2B shows an embodiment of the electrical key **150**  
using the key **150** itself as a ground (-) electrode, and using an additional  
connector **212** from the handle of the key **150** to serve as the positive (+)  
electrode.

In applications where the rechargeable key chain device **100**  
20    will be plugged in 'hot', i.e., with power applied, it may be desirable to  
locate the electrical contacts such that the negative (-) polarity contact is  
connected sufficiently prior to contact of the positive (+) polarity contact, to  
minimize the chance for damage to the key chain rechargeable device  
**100**.

25    Fig. 3A shows an exemplary alternative embodiment where  
a device securing a key contacts matching contacts at a matching  
keyhole, in accordance with the principles of the present invention.

In particular, as shown in Fig. 3A, two plunger type electrical  
contacts **302**, **304** on the key chain rechargeable device **100b** are brought  
30    into contact with associated contact areas **306**, **308** associated with the

power source (e.g., with the vehicle) when the captured key is inserted into the lock tumbler **170**. This provides the necessary electrical contact to allow for unconscious recharging of the rechargeable batteries **120** in the key chain rechargeable device **100** whenever the captured key **150** is in use it its matching keyhole.

It is also possible to implement recharging without the need for direct electrical contact between the key chain rechargeable device and a matching keyhole using inductive coupling.

For instance, Fig. 3B shows another exemplary alternative embodiment utilizing inductive coupling between an energy coil **322** associated with a power source, e.g., a vehicle **310b**, and a recharging coil **320** associated with a key ring **390** in close proximity to the energy coil **322**, in accordance with the principles of the present invention.

In particular, as shown in Fig. 3B, an inductive energy coil **322** is located in close proximity to a keyhole **381** matching a key **160** which is either loose or captured in a key chain rechargeable device **100c**. The key chain rechargeable device **100c** includes a mating recharging inductive coil **320**. A suitable inductive load driving circuit **394** drives the energy coil **322**, and a suitable inductor receiving circuit **393** draws power from the recharging coil **320**.

While inductive coupling is advantageous, due to the size of the energy coil **322** and particularly the recharging coil **320**, it is more preferable in applications where space is not as much of a concern. Moreover, the energy efficiency of inductive coupling efficiency is significantly less than the energy efficiency of direct electrical contact techniques, and is preferred where power source energy is less of a concern.

Fig. 4 shows implementation of a rechargeable key short range wireless device, such as a BLUETOOTH™ network device, in accordance with the principles of the present invention.

Piconets, or small wireless networks, are being formed by more and more devices in many homes and offices. In particular, a popular piconet standard is commonly referred to as a BLUETOOTH™ piconet. Piconet technology in general, and BLUETOOTH technology in particular, provides peer-to-peer communications over short distances.

The wireless frequency of piconets may be 2.4 GHz as per BLUETOOTH standards, and/or typically have a 20 to 100 foot range. The piconet RF transmitter may operate in common frequencies which do not necessarily require a license from the regulating government authorities, e.g., the Federal Communications Commission (FCC) in the United States. Alternatively, the wireless communication can be accomplished with infrared (IR) transmitters and receivers, but this is less preferable because of the directional and visual problems often associated with IR systems.

A plurality of piconet networks may be interconnected through a scatternet connection, in accordance with BLUETOOTH protocols. BLUETOOTH network technology may be utilized to implement a wireless piconet network connection (including scatternet). The BLUETOOTH standard for wireless piconet networks is well known, and is available from many sources, e.g., from the web site [www.bluetooth.com](http://www.bluetooth.com).

The present invention provides a convenient and inconspicuous way to recharge wireless network devices such as a BLUETOOTH network device 400 attached to a key chain, as depicted in Fig. 4.

Fig. 5 shows implementation of a rechargeable key security alarm enable/disable device, in accordance with the principles of the present invention.

In particular, as shown in Fig. 5, conventional security alarm enable/disable devices can have their disposable batteries replaced with rechargeable batteries (and a charging circuit if not included in the power

source connection) in accordance with the principles of the present invention. In this way, a user need never worry about replacement of spent batteries in a security alarm enable/disable device, nor be disrupted by the down time associated with the inconvenient timing of battery outages.

Fig. 6 shows implementation of a rechargeable key chain keyless entry remote device, in accordance with the principles of the present invention.

In particular, similar to the replacement of disposable batteries in a key chain rechargeable security alarm enable/disable device 500 as shown and described with reference to Fig. 5, so too may a key chain rechargeable keyless entry remote device 600 include rechargeable batteries and a charging circuit which is charged when a key on the key chain is inserted into a matching keyhole.

Fig. 7 shows the otherwise conventional disposable batteries of a key penlight device may be replaced with rechargeable batteries and charging circuit, in accordance with the principles of the present invention.

Accordingly, a key chain rechargeable device in accordance with the present invention allows a simple and convenient way for a user to keep a rechargeable battery charged without the need for the user to remember to plug the device in somewhere.

The principles of the present invention may be used in conjunction with other methods of powering devices. For instance, a key chain rechargeable device may be partially or fully powered in addition to recharged when a key on the key chain is in its keyhole.

While shown and described with primary reference to vehicles and vehicle locks, the present invention relates equally to other types of locks where a key on a key chain is kept in extended use in a key hole.

A key chain or key securing structure as referred to herein is any ring, chain, string, wallet, plastic encasement or other apparatus which is attached to one or more keys.

5 In another embodiment, a separate charging key hole matching a key on a rechargeable key chain may be located, e.g., in a house as a way to charge the rechargeable key chain battery even when not in the car. The separate charging key hole may be a “dummy” key hole in that it has no locking/unlocking function. Rather, it is merely a means to allow contact between the rechargeable key chain and an  
10 auxiliary recharging source.

Thus, in this embodiment, rather than hanging keys from a hook, leaving them on a shelf, etc., a user would stick the matching key in the charger key hole.

15 While the invention has been described with reference to the exemplary embodiments thereof, those skilled in the art will be able to make various modifications to the described embodiments of the invention without departing from the true spirit and scope of the invention.